

brush, and from the servings of a tube of toothpaste, the system can deduce how much toothpaste is left and when it should be refilled. In another example, the system can monitor clothes entering a washing machine, and from this information the predicted durability of replacement needed on each article of clothing may be determined.

**[0042]** FIG. 1 is a component model of an environment in which embodiments may be practiced.

**[0043]** A user environment in which a customer 15 resides, operates, or otherwise moves, may include a facility at which one or more items 21 may require replenishment, replacement, upgrade, or other modification. The user environment 18 may be a home, business, or other location. In other embodiments, the user environment 18 may include an open area, such as a field, parking lot, and so on. The items 21 may each include an identifier tag 22 that collects data about the items 21. For example, the item 21 to which an identifier tag 22 may be attached may be a physical consumer good, such as a store product. The tag 22 may be provided at the time of manufacture or delivery of the item 21, or by the retailer providing the item 21 to the customer 15. In some embodiments, tags may be provided on the consumer goods 21 directly by the customer 15, for example, customers who wish to track certain items. An identifier tag 22 may include a unique identification and information about the item 21 to which it is associated. The tag 22 may include an electronic device such as a circuit for storing and processing this information. In some embodiments, an association between tag 22 and item may be made at an electronic checkout. In some embodiments, a tag 22 may be unknown, i.e., not associated with an item, but nevertheless identified by a reader 12. Here, the RTMS 10 may indicate that there is no associated item 21, whereby the user 15 may inform the RTMS 10 that the tag 22 is indeed associated with a particular item 21. The RTMS 10 may provide questions, for example, in an electronic format displayed at the user's mobile electronic device 17, which when answered results in an association between the tag 22 and the item 21.

**[0044]** In some embodiments, a scanning device, for example, a QR code reader on an electronic device 17, or the tag reader 12 on an appliance 23 may be used to perform an initial scan of a QR code or the like from the tag 22. The QR code may supply the information about the corresponding item, for example, the item's unique identification and other data, to the reader, which can subsequently be processed by the electronic device 17, such as a smartphone or other computer.

**[0045]** The tag 22 may include an antenna for transmitting a beacon or other signals to a reader 12. The tags 22 may be constructed and arranged to sense and monitor consumption, use, location, movement, and/or other change with respect to the consumer goods 21. For example, a tag 22 may be located in a water filter and collect data on an amount of water remaining in the water filter. This data can be used to determine when the water filter is at or near empty and requires refilling. In another example, a tag 22 may sense and monitor an amount of use of a computer, television set, or other electronic device. This data can be used to predict the life expectancy of the item of interest, and establish whether the device requires an upgrade or replacement based on the amount of use of the device. The tags 22 can communicate using radio frequency identification (RFID) or the like. IoT items 21 may be tagged as barcoded, Bluetooth,

radio frequency (RF), RFID, infrared (IR), near field communication (NFC), or any other suitable device that can provide its identifier and attributes to one or more tag readers 12 and/or beacon devices that track tag locations when queried over a short range interface.

**[0046]** One or more tag readers 12 may communicate with the tags 22 for receiving tag data. For example, a tag 22 may emit a beacon or other signal that includes a unique identification of the item 21 to which the tag 22 is attached. The tag readers 12 may be part of, or complement, an electronic boundary defining the user environment 18, such as a geofenced region, WiFi network, and so on, for example, reading RFID signals or the like output from the tags 22. One or more tag readers 12 may be positioned at the user environment 18, such as a home, business, gym, automobile, or anywhere items can be tracked. A reader 12 can read the tags 22 through use of radio waves or other frequency signal. In some embodiments, a beacon signal output by a tag reader 12 may energize a tag 22 in communication with the tag reader 12. As the tag 22 gets closer to a reader 12, the tag 22 may emit a stronger signal, enabling the location to be triangulated where items 21 are located and how they are moved. Scanners, beacons, readers, or the like may operate to permit the items 21 to be tracked in real time, for example, priority track items.

**[0047]** The tags 22 can be used to determine usage and movement information about the goods 21 to which the tags 22 are attached. The tag reader 12 can forward data received from the tags 22, e.g., tag identifier information, usage or movement data, and so on, to a retail subscription management system (RTMS) 10 an electronic network, for example, the Internet. This data can be used to predict when items should be replenished, replaced, or upgraded automatically.

**[0048]** A combination of the tags 22, tag readers 12, and RTMS 10 may form at least part of an IoT environment. As described, the tags 22 identify the items 21 and outputs to item identifiers via a reader 12 to the RTMS 10. A reader 12 may also detect movement of the tracked item 21 by communicating with the corresponding tag 22, and communicate the movement data to the RTMS 10 via the Internet.

**[0049]** The RTMS 10 may receive IoT data, for example, via the tag reader 12. IoT data may include the unique identification of the tagged item 21, which is received by the reader 12. For example, clothes may be tagged and placed in the closet might indicate that the clothes are new and recently purchased and stored at the consumer's home, for example, in a closet or bureau. The system can distinguish the location of the clothes, for example, hung in a closet, or placed in a washing machine. In the latter case, the IoT data can establish that the clothes have been used. As clothes are predicted to expire, the system may predict the number of uses based upon prior data collected on these types of clothes from the manufacturer. When a certain threshold was set by the manufacture as to the durability of the articles, a new set of clothes may be automatically ordered.

**[0050]** The RTMS 10 may store a set of records that include a tag identifier and an item identifier so that the system 10 knows what tags 22 are on what items 21. Thus, the RTMS 10 associates the tag 22 with the consumer goods 21. The association can be formed, or established, at a time of purchase where the purchase data may be electronically communicated at the time of the e-receipt. In another example, the association could be set by the customer 15 by scanning the QR code and a tag receiver picking up the